### Management, Productivity & Technology

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#### Ohio, USA

#### Maharashtra, India

# How Much of the TFP Spread across Firms and Countries can Management Explain?

- Evidence of massive country and plant spread in TFP: e.g. Hall and Jones (1999) Syverson (2011)
- How far can management practices account for these differences?
- Management theories differ, spanning two broad views:
  - <u>Management as Technology (MAT)</u>: management key driver of performance gaps (Walker, 1887, Marshall 1887)
  - <u>Management as Design (MAD)</u>: management just a style nothing on average is better or worse (Woodward, 1958, core Org-Econ)

### Summary of the paper

- 1. Management data from  $\approx$  10,000 firms in 20 countries
  - US highest (unweighted) average management score
  - US lead much larger if size weighted (more reallocation)
- 2. Develop model of Management as a Technology (MAT) & show predictions consistent with data:
  - Performance
  - Reallocation
  - Competition
  - Skills
- 3. Given MAT, estimate management can account for very roughly ≈ 25% of plant and country spread in TFP

**Management Data** 

A Simple Model of Management

Testing the Predictions

Management and cross-country and firm TFP

#### Survey methodology (following Bloom & Van Reenen (2007))

#### 1) Developing management questions

 Scorecard for 18 monitoring and incentives practices in ≈45 minute phone interview of manufacturing plant managers

#### 2) Getting firms to participate in the interview

- Introduced as "Lean-manufacturing" interview, no financials
- Official Endorsement: Bundesbank, RBI, PBC, World Bank etc.

#### 3) Obtaining unbiased comparable responses, "Double-blind"

- Interviewers do not know the company's performance
- Managers are not informed (in advance) they are scored

Example monitoring question, scored based on a number of questions starting with "*How is performance tracked?*"

Score	(1): Measures tracked do not indicate directly if overall business objectives are being met. Certain processes aren't tracked at all	(3): Most key performance indicators are tracked formally. Tracking is overseen by senior management	(5): Performance is continuously tracked and communicated, both formally and informally, to all staff using a range of visual management tools

**Note:** All 18 questions and over 50 examples in Bloom & Van Reenen (2007) & Appendix D

http://worldmanagementsurvey.org/

Example incentives question, scored based on questions starting with "How does the promotion system work?"

				1
Score	(1) People are promoted primarily upon the basis of tenure, irrespective of performance (ability & effort)	(3) People are promoted primarily upon the basis of performance	(5) We actively identify, develop and promote our top performers	

### Plant locations from World Management Survey (~8,000 firms, 3 major waves: 2004, 2006, 2009; 20 countries)



Medium sized manufacturing firms(50-5,000 workers, median≈250) Now extended to Hospitals, Retail, Schools, etc.

Extension to nearer population surveys (e.g. US MOPs)

### ADDITIONAL CONTROLS FOR "NOISE"

### INTERVIEWEE CONTROLS

 Gender, seniority, tenure in post, tenure in firm, countries worked in, foreign, worked in US, plant location, reliability score

### INTERVIEWER CONTROLS

 Set of interviewer dummies, cumulative interviews run, prior firm contacts

#### TIME CONTROLS

• Day of the week, time of day (interviewer), time of the day (interviewee), duration of interview, days from project start

# Summer 2013 wave adds Africa & more Latin American countries



Data includes 2013 survey wave as of Oct 4<sup>th</sup> 2013

## Average management scores across countries are strongly correlated with GDP per capita



Data includes 2013 survey wave as of 9/20/2013. Africa data not yet included in the paper

#### FIGURE 2: HUGE VARIATION IN MANAGEMENT SCORES ACROSS FIRMS WITHIN COUNTRIES



Note: Bars are the histogram of the actual density. Scores from 9,995 management interviews across 20 countries.

### FAMILY-RUN FIRMS TYPICALLY HAVE THE WORST MANAGEMENT



Management scores after controlling for country, industry and number of employees. Data from 9085 manufacturers and 658 retailers. "Founder owned, founder CEO" firms are those still owned and managed by their founders. "Family firms" are those owned by descendants of the founder "Dispersed shareholder" firms are those with no shareholder with more than 25% of equity, such as widely held public firms.

#### MULTINATIONALS APPEAR TO ACHIEVE GOOD MANAGEMENT PRACTICES WHEREVER THEY LOCATE



Sample of 7,262 manufacturing and 661 retail firms, of which 5,441 are purely domestic and 2,482 are foreign multinationals. Domestic multinationals are excluded – that is the domestic subsidiaries of multinational firms (like a Toyota subsidiary in Japan).

Management Data

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# Traditional view of management is as a driver of firm performance: Francis Walker

"It is on account of the wide range [of ability] among the employers of labor that we have the phenomenon in every community and in every trade some employers realizing no profits at all, while others are making fair profits; others, again, large profits; others, still, colossal profits."



Francis Walker (QJE, April 1887)

Walker ran the 1870 US Census, and was the founding president of the AEA and 2nd president of MIT

# Traditional view of management is as a driver of firm performance: Alfred Marshall

"I am very nearly in agreement with General Walker's Theory of profits....the earnings of management of a manufacturer represents the value of the addition which his work makes to the total produce of capital and industry...."



Alfred Marshall (QJE, July 1887)

# So define a highly *stylized* Management As a Technology (MAT) model

Production Function:  $Y = AK^{\alpha}L^{\beta}M^{\gamma}$  where M = management

Assume: Firms pay for M which depreciates (like R&D)

Other assumptions

- $-\tau$ % of sales lost to distortions (bribes, regulations etc)
- M (like A and  $\tau$ ) drawn randomly at birth
- Changing M & K involves adjustment costs (L flexible)
- Monopolistic competition (Iso-elastic demand,e)
- Sunk entry cost ( $\kappa$ ) & fixed per period operating cost (F)

### We simulate this management model

1. Entrants pay a sunk cost E for a draw on (A,M,τ). Free entry condition determines number of entrants

2. Each period firms receive TFP shock,  $\epsilon_t$ ;  $A_t = \rho A_{t-1} + \epsilon_t$ 

3. Pay fixed operating cost F per period (or exit)

4. Invest in M & K, plus choose optimal labor

### **Obtain four basic predictions from MAT**

**1)** Performance  $\uparrow$  in management



#### 3) Management $\downarrow$ in distortions



#### 2) Management $\uparrow$ in competition



#### 4) Management $\downarrow$ as its price rises



Notes: Simulate 2,500 firms per year in the steady state. Plots normalized log(management) on a 1 to 5 scale.

### Very stylized model with obvious extensions

- Dynamics: maybe management also changes adjustment costs, information (forecasting) and factor prices
- Multi-factor: currently 1-dimensional M, but under "Design" model sub-components of management styles
- Spillovers: Technology could be (partially) non-rival so spillovers (a la Bloom, Schankerman & Van Reenen, 2013, Econometrica)
- Governance/ownership issues: family firms, FDI, etc. (could consider initial draw of M a reduced form way of proxying this)
- Co-ordination: e.g. Gibbons & Henderson (2012)

Measuring Data

Management Models

### **Testing the Predictions**

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Management and cross-country TFP

The traditional British Chat-Up

[Male manager speaking to an Australian female interviewer]

*Production Manager:* "Your accent is really cute and I love the way you talk. Do you fancy meeting up near the factory?"

Interviewer "Sorry, but I'm washing my hair every night for the next month...."

The traditional Indian Chat-Up

Production Manager: "Are you a Brahmin?"

Interviewer "Yes, why do you ask?"

Production manager "And are you married?"

Interviewer "No?"

*Production manager* "Excellent, excellent, my son is looking for a bride and I think you could be perfect. I must contact your parents to discuss this"

#### Moments: Sales are increasing in management



Management is the average of all 18 questions (set to sd=1). Sales is log(sales) in US\$. N=10197

### TABLE 2: Performance in general is robustly *correlated* with management (consistent with MAT)

Dependent variable	Ln(sales)	TFP	Ln(sales)	Ln(employ -ment)	Profit rate ROCE	5yr Sales growth	Exit
	OLS	(Olley- Pakes	Fixed Effects	OLS	OLS	OLS	OLS
Firm sample	All	2+ surveys	2+ surveys	All	All	All	All
Manage- ment(SD=1)	0.150*** (0.016)	0.134*** (0.020)	0.033** (0.013)	0.338*** (0.015)	1.202*** (0.264)	0.039*** (0.013)	-0.006*** (0.002)
Ln(emp)	0.645*** (0.024)	0.621*** (0.050)	0.374*** (0.096)				
Ln(capital)	0.307*** (0.019)	0.333*** (0.034)	0.237*** (0.096)				
Obs	8,314	6,364	6,364	15,608	9,163	8,365	7,532

*M*, Management Index is z-score of average 18 questions z-scored (sd=1). Other controls include % employees with college, av hours, firm age, 3-digit industry, country & time dummies & noise controls (e.g. interviewer dummies). Standard errors clustered by firm.

#### **RANDOMIZED CONTROL TRIALS: BLOOM ET AL (2013)**

- Experiment on plants in Indian textile firms outside Mumbai
- Randomized treatment plants get heavy management consulting, control plants get very light consulting (just enough to get data)
- Collected weekly performance data on all plants from 2008 to 2011
- •Improved management practices led to large & significant improvements in:
  - Productivity: sd increase in management caused 10% higher TFP
  - Profitability: around \$325k p.a. compared to ~\$200k market cost of consultancy

#### PRODUCTIVITY IMPROVEMENTS IN RCT ON ADOPTION OF MANAGEMENT PRACTICES



Weeks after the start of the management changes

**Notes:** Weekly average total factor productivity for the 14 treatment plants which adopted modern management practices for quality, inventory and production efficiency and the 6 control plants. All plants make cotton fabric near Mumbai, India, with between 100 and 1000 employees. Values normalized so both series have an average of 100 prior to the start of the intervention. Confidence intervals bootstrapped over firms. **Source:** Bloom, Eifert Mahajan, McKenzie, Roberts (2013).

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Management and cross-country TFP

### **EXAMINING THE ROLE OF REALLOCATION**

$$Y_{ijk} = \alpha M_{ijk} + \beta (M * REALLOCATION)_{ijk}$$
$$+ \gamma REALLOCATION_{ijk} + u_{ijk}$$

- $Y_{ijk} = SIZE$  (or *GROWTH*) for firm *i* in industry *j* country *k*
- REALLOCATION = strength of reallocation forces in firm's environment (expect β > 0)
  - Set of **country dummies**, with US as base
  - Explicit **policy** variables (e.g. country labor regulation indices) & industry\*country policies (e.g. trade barriers)
  - Shocks like Great Recession 2008-09 (also have industry\*country variation)

### Table 6: More reallocation to better managed firms in the US where markets generally less distorted (consistent with MAT)

Dependent Variable	Employees	Employees	Sales Growth	
Management	201.9***	359.7***	0.092***	
MNG*Argentina		-270.9**	-0.134***	
MNG*Australia		-259.3*	-0.145**	
MNG*Brazil		-211.7*	-0.101***	
MNG*Canada		-169.3	-0.131**	
MNG*Chile		-92.6	-0.150	
MNG*China		-84.9	-0.060	
MNG*France		-489.5**	-0.085*	
MNG*Germany		-9.0	-0.080*	
MNG*Greece		-355.9***	-0.089**	
MNG*India		-145.4	-0.066	
MNG*Ireland		-258.8**	-0.085	
MNG*Italy		-283.1***	-0.092**	
MNG*Mexico		-250.1*	-0.075*	
MNG*New Zealand		-375.7*	0.718***	
MNG*Japan		-297.3**	-0.099**	
MNG*Poland		-308.1***	-0.058	
MNG*Portugal		-308.9***	-0.109**	
MNG*Sweden		-228.7*	-0.068	
MNG*UK		-125.1	-0.054	
Observations	5,842	5,842	2,756	

Notes: US is the omitted country in columns 2 and 3. Includes year, country, 3-digit SIC dummies, firm and noise controls

### Reallocation stronger in countries with lower labor and trade restrictions

Dependent Variable:	Employment					
Management (MNG)	231.46***	356.73***	110.97*			
	(37.12)	(55.89)	(66.30)			
Management*Employment Protection	-1.43**					
(World Bank Country Index)	(0.69)					
Management*Trade Costs		-0.18***				
(World Bank Country Cost)		(0.05)				
Tariffs			-4.96			
(country x industry)			(4.12)			
Management*Tariff			-8.25**			
			(3.35)			
Management*country interaction	No	No	Yes			
Observations	5,760	5,017	1,559			

**Notes:** OLS, clustered by firm; dependent variable is firm employment; Domestic firms only. Controls for firm age, skills, noise, SIC3, country dummies, EPL(WB) is "difficulty of hiring" from World Bank (1=low, 100=high). Trade cost is the cost in \$ to export to the country (World Bank). Last columns tariffs are MFN country-by-industry rates (in deviations from country-industry mean) from Feenstra and Romalis (2012).

### Reallocation stronger in industry\*country pairs hit hardest by Great Recession (TAB 3)

Dependent variable	n firm sales			
SHOCK (Industry Sales)	-0.033**	-0.035**		
	(0.014)	(0.014)		
Management <sup>06</sup> *SHOCK		0.027**		
5		(0.011)		
SHOCK (Industry Exports)			-0.051***	-0.052***
			(0.014)	(0.014)
Management <sup>06</sup> *SHOCK				0.018*
				(0.010)
Management <sup>06</sup>	0.002	-0.014	0.001	-0.008
	(0.006)	(0.010)	(0.006)	(0.009)
Firms	1,567	1,567	1,599	1,599
Observations	1,653	1,653	1,685	1,685

**Notes:** SHOCK is a binary indicator for a fall in sales or a fall in exports in the SIC3 by country cell from 2007 to 2009. All columns include controls for skills, firm and plant size, noise, country and industry dummies. Management from 2006

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Management Models

#### **Testing the Predictions**

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Management and cross-country TFP

# TABLE 5: Competition associated with improved management

Competition proxies	Ma (estim	Management (estimated in <u>levels</u> )			Management (estimated in <u>difference</u>		
Import penetration	0.805*** (0.236)			0.608*** (0.230)			
1- Lerner Index <sup>1</sup>		17.53* (3.85)			20.68** (6.65)		
# of reported competitors			0.121*** (0.023)			0.120** (0.052)	
Balanced panel	Νο	Νο	No	Yes	Yes	Yes	
Obs	2,657	2,819	2,789	412	429	432	

**Notes:** Includes SIC-3 industry, country, firm-size, public and interview noise (interviewer, time, date & manager characteristic) controls. Col 1,2, 4 & 5 clustered by industry\*country, cols 3 & 6 by firm. Four core countries in 2004 and 2006 (France, Germany, UK and US)

### **IS COMPETITION EFFECT CAUSAL?**

- Also use natural experiments to generate exogenous increases in competition
- Growth of Chinese imports (e.g. WTO accession & MFA textile quotas in Bloom, Draca & Van Reenen (2013)
  - Big improvement in management & productivity in more affected sectors
- Hospital competition in UK under mid-2000s Blair reforms (Bloom, Propper, Seiler & Van Reenen, 2013)

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# Management and Education: UNESCO World Higher Education Database university locations (N=9,081)



#### EDUCATION FOR NON-MANAGERS AND MANAGERS APPEAR LINKED TO BETTER MANAGEMENT



Sample of 8,032 manufacturing and 647 retail firms.

# Distance to the nearest university is correlated with firm skills and management

Dependent Variable:	Manage ment	% firm employees with degree	Manage ment	Manage ment
	OLS	OLS	OLS	IV
Drive time to nearest	-0.049***	-1.534***		
university	(0.019)	(0.423)		
% employees with			0.789***	3.190***
degree in the firm			(0.082)	(1.113)
Observations	6,406	6,406	6,406	6,406

**Notes:** Clustered by 313 regions. In final column proportion skilled is instrumented with distance to university. Controls include industry, regional (e.g. US state), local population density, distance to coast, weather and full set of firm and noise controls.

Source: Feng (2013)

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# Following MAT we can estimate rough contribution of management to country TFP spread

- 1. Estimate country differences in *size weighted* management
- 2. Impute impact of this on differences in TFP

Requires many assumptions, so only rough magnitude calculation

# First calculate the employment weighted difference in management (from the US as baseline)



**Notes:** Total weighted mean management deficit with the US is the number on top of bar. This is decomposed into (i) reallocation effect (blue bar) and (ii) unweighted average management scores (red bar). Domestic firms, scores corrected for sampling bias

# First calculate the employment weighted difference in management (from the US as baseline)



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# Second, estimate impact of management on TFP using result from field experiments (and micro regressions) that $\uparrow$ 1 SD management $\approx \uparrow$ 10% TFP

	Share-Weighted Average Management		TFP GAI with US	P Proportion gap du	of TFP e to
Country	Deficit wit	h US		Manage	ment
US	0				
Sweden	-0.25		32.2	7.8%	6
Japan	-0.35		33.6	10.49	%
Canada	-0.50		22.3	22.4	%
Great Britain	-0.74		20.3	36.5	%
Italy	-0.81		17.2	47.79	%
France	-0.82		25.3	38.7	%
Brazil	-0.98		59.6	16.9	%
China	-1.01		78.3	14.9	%
Argentina	-1.17		57.3	20.6	%
Portugal	-1.18		24.9	48.2	%
Greece	-1.65		51.0	32.4	%
Unweighted av.				25%	, D

Assume one sd increase in management increases TFP by 10%. Regressions suggest about 5% to 15% depending on specification. TFP data from Jones and Romer (2010).

# Preliminary estimates of contribution of management to within-country TFP spread ~1/3

Country	90	)-10 gap in:	% accounted for	TFP spread source:
	TFP	Management	by management	
US	90%	2.7 SDs	30%	Syverson (2004)
UK	110%	3.0 SDs	38%	Criscuolo, Haskel and Martin (2003)

**Note:** Management share imputed assuming that  $\uparrow 1$  SD management  $\approx \uparrow 10\%$  TFP Using US MOPs on entire firm size distribution US figure is 21%

### Management as Design

- Evidence that sub-components of scores have a contingent element (e.g. people vs. others)
  - Factor analysis
  - Relative people scores stronger when industry is
    - R&D intensive
    - Less capital intensive
    - More skills intensive
- For overall management score less clear
  - Consider a design model where optimal style industry\*country specific. Predictions counter-factual
  - Symmetric increase in performance above/below industry mean

# Design of types of practice: Firms in capital intensive & low tech sectors focus on monitoring)

	Industry Specific US SIC-4 values (NBER, NSF)					
	People Manage ment	Monitori ng &Targets	Relative Manage ment			
	(P)	(MT)	(P-MT)			
In(Capital-	0.027	0.108***	-0.106***			
Labor ratio)	(0.018)	(0.023)	(0.022)			
<b>R&amp;D</b> Intensity	-0.002	-0.247**	0.312***			
	(0.057)	(0.097)	(0.091)			
In(%degree)	0.197***	0.174***	0.016			
[firm]	(0.010)	(0.011)	(0.014)			
Observations	9,545	9,545	9,545			

Controls: firm & plant size; firm age, competition, Country by year dummies, SIC-2

#### MANAGEMENT COEFFICIENTS SYMMETRIC ABOVE AND BELOW CELL AVERAGE

Dependent Variable	Product	Product	Product	ROCE	Sales	Exit
	-ivity	-ivity	-ivity		growth	
Cell	SIC3	Country	SIC3	SIC3	SIC3	SIC3
	<b>×Country</b>			×Cty	×Cty	×Cty
Management	0.236***	0.219***	0.226***	1.681***	0.038	-0.018**
*I( <i>M</i> below cell average)	(0.032)	(0.034)	(0.039)	(0.528)	(0.028)	(0.005)
Management	0.226***	0.219***	0.223***	1.679***	0.044*	-0.014**
*I( <i>M</i> above cell average)	(0.027)	(0.030)	(0.030)	(0.436)	(0.024)	(0.004)
r i i i i i i i i i i i i i i i i i i i						
p-value of F: symmetry	0.230	0.984	0.785	0.990	0.388	0.060
above & below cell mean						
Cell Clusters	796	18	177	900	921	1,137
Observations	8,003	8,314	8,292	8,793	8,007	6,607

**Notes:** Regressions includes controls for country, SIC4 & year dummies, firm-age, average hours, % with degrees, noise controls etc. SE clustered by firm. Productivity columns from regression of In(sales) as dependent variable with controls for In(labor) and In(capital). Only cells with 2+ observations used.

### Conclusions

- Large spreads in size weighted management across firms and countries, with about 1/3 of US lead due to reallocation
- Micro data consistent with a model in which this variation in management is technology (much like process R&D)
- Estimate variations in management accounts for ≈25% of plant and country variation in TFP (greater share explained in more developed countries)

#### CONCLUSIONS

- Heterogeneity in firm productivity linked to management
  ~25% of cross-country TFP gap (reallocation 1/3)
- Management as a "technology"
  - Management improves firm performance
  - Reallocation stronger in US
    - Linked to trade & labor regulations
    - Stronger in Great Recession
  - Competition & skills improve management quality

#### Next Steps:

- Management & managers (German IAB)
- Dynamics & spillovers (US MOPs)
- Other determinants of PPDs (co-ordination a la Gibbons and Henderson, 2012)

#### Don't get sick in Britian

Interviewer : "Do staff sometimes end up doing the wrong sort of work for their skills?

NHS Manager: "You mean like doctors doing nurses jobs, and nurses doing porter jobs? Yeah, all the time. Last week, we had to get the healthier patients to push around the beds for the sicker patients"

#### Don't do Business in Indian hospitals

Interviewer: "Is this hospital for profit or not for profit"

Hospital Manager: "Oh no, this hospital is only for loss making"



#### The difficulties of defining ownership in Europe

Production Manager: "We're owned by the Mafia" Interviewer: "I think that's the "Other" category......although I guess I could put you down as an "Italian multinational" ?"

#### Americans on geography

Interviewer: "How many production sites do you have abroad? Manager in Indiana, US: "Well...we have one in Texas..."